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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/628,507	07/29/2003	Kuo-Chien Wu	WUKU3005/EM	5074
23364	7590	10/06/2004	EXAMINER	
BACON & THOMAS, PLLC 625 SLATERS LANE FOURTH FLOOR ALEXANDRIA, VA 22314			NOVACEK, CHRISTY L	
			ART UNIT	PAPER NUMBER
			2822	

DATE MAILED: 10/06/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/628,507

Applicant(s)

WU ET AL.

Examiner

Christy L. Novacek

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 July 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 and 4-8 is/are rejected.
- 7) ☒ Claim(s) 2 and 3 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

This office action is in response to the amendment filed July 1, 2004.

Response to Amendment

The amendment to the specification is sufficient to overcome the objection to the drawings stated in the previous office action. Therefore, this objection is withdrawn.

The limitations added to claims 2 are sufficient to overcome the Dennison (US 6,696,355) and Avanzino et al. (US 5,795,823) references either alone or in combination. Neither Dennison nor Avanzino teach the limitation of forming a first dielectric layer on the plug after it has undergone the step of having the oxidized portion of it removed such that the upper surface of the plug that has previously had the oxidized portion removed is exposed. Therefore, the rejections of claims 2 and 3 under 35 U.S.C. 102(e) are hereby withdrawn.

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 4 and 6 are rejected under 35 U.S.C. 102(e) as being anticipated by Dennison (US 6,696,355, previously cited).

Regarding claim 1, Dennison discloses forming a plug (230/250) in an oxide layer (210), removing some of the oxide layer to make the plug protrude, oxidizing an exposed region of the protruding plug to form an oxidized portion and removing the oxidized portion of the plug so as to decrease an area of the top surface of the plug (Fig. 10-14; col. 5, ln. 50 – col. 8, ln. 67).

Regarding claim 4, Dennison discloses forming a plug (230/250) in an oxide layer (210), removing some of the oxide layer to make the plug protrude, oxidizing an exposed region of the protruding plug to form an oxidized portion, removing the oxidized portion of the plug so as to decrease an area of the top surface of the plug, forming a first dielectric layer (242) on the upper surface of the entire structure such that the upper surface of the plug is exposed, forming a second dielectric layer (330) on the upper surface of the first dielectric layer including the upper surface of the plug, and forming a conducting wire (340/350) in the second dielectric layer (Fig. 10-16; col. 5, ln. 50 – col. 10, ln. 31).

Regarding claim 6, Dennison discloses planarizing the first dielectric layer (242) after it is formed (col. 8, ln. 63-66).

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 5, 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dennison (US 6,696,355) in view of Avanzino et al. (US 5,795,823, previously cited).

Regarding claim 5, Dennison discloses forming an opening in the second dielectric layer and filling the opening with metal so as to form the conductive wire, but Dennison does not disclose the specific process for forming the conductive wire. Instead Dennison states, “Techniques for introducing dielectric material 330, forming and filling conductive vias, and planarizing are known to those skilled in the art.” Like Dennison, Avanzino discloses forming a conductive wire in a dielectric layer. Avanzino states that the openings for the wire can be formed in the dielectric layer by coating a photoresist on the dielectric layer, forming an

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opening of a predetermined pattern in the second dielectric layer by exposing, developing and etching, and filling metal in the opening to form a conducting wire (Fig. 3a-4p; col. 5, ln. 13 – col. 7, ln. 40). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the via-etching method of Avanzino to create the via opening of Dennison because Dennison states that conventional processes known in the art should be used to form the opening and Avanzino discloses one such successful method.

Regarding claims 7 and 8, Dennison discloses that layer 242 (the “first dielectric layer”) is a dielectric but does not disclose from what material the layer is made. Dennison discloses that the layer 330 (the “second dielectric layer”) can be made of “for example, SiO₂ or other suitable material”. Like Dennison, Avanzino discloses forming a conductive wire in dielectric layers. Avanzino teaches that a conductive wire can be formed in a dielectric layer of one continuous type of dielectric by using a timed etch to form the via/trench that the wire material will fill (Fig. 3a-3e). As such, the efficiency of the wire forming process is improved by precluding the need for different dielectric layers to be deposited. Avanzino teaches that in addition to the previous method, the conductive wire may also be formed by using different dielectric layers stacked upon one another (Fig. 4a-4p). In this way, the etching selectivity between the layers can be used to precisely etch the trench/via without need for a timed etch. As such, the quality of the wire forming process is improved by offering a more precise trench/via etch. At the time of the invention, it would have been obvious to one of ordinary skill in the art to form the first and second dielectric layers of Dennison either of both the same material (in the event that efficiency of the conductive wire formation process is more important than the quality) or to form the first and second dielectric layers of two different materials (in

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the even that the quality of the conductive wire is more important than the efficiency of the process).

Response to Arguments

Applicant's arguments filed July 1, 2004 have been fully considered but they are not persuasive.

Regarding the rejection of claims 1 and 4 as being anticipated by Dennison, Applicant argues that Dennison allegedly fails to disclose the limitations of oxidation of a contact structure followed by removal of the oxidized portion. Applicant then goes on to state that Figures 12A and 12B of Dennison refer to different embodiments and cannot be combined. In the rejection made in the previous office action and in the rejection above, no mention was made of Figure 12B and no desirability to combine the embodiments of Figure 12A and 12B was recited, so it is unclear as to where Applicant gets the idea that the Examiner was arguing for the combination of these two embodiments. The Examiner relies on Figure 12A of Dennison which shows the limitation of oxidizing the upper portion of the plug and Figures 13 and 14 which show the subsequent step of removing the oxidized area from the top surface of the plug. Figures 13 and 14 clearly show Dennison discloses removing an oxidized region of the plug. Furthermore, Applicant's attention is directed to lines 49-57 of column 8 of Dennison which state:

“In order to achieve both upper surface 246 of upper section 232 and second dielectric film upper surface 248, a planarization process is carried out. Preferably, a spacer etch is carried out on second dielectric film 242. More preferably, the spacer etch *will remove substantially completely oxidized material in upper section 232 to form an exposed lower electrode core 252*, an exposed lower electrode transition section 254 if present, and an exposed lower electrode dielectric husk 256 if present.” (emphasis added)

Therefore, the rejection of claims 1, 4 and 6 as being anticipated by Dennison is maintained.

Regarding the rejection of claims 5, 7 and 8 as being unpatentable over Dennison in view of Avanzino, Applicant admits that the limitations found in those claims are known in the art. Applicant's argument that Avanzino does not disclose the limitations of forming a bit line in trenches on top of the contact structure is deemed irrelevant as these limitations are not recited anywhere in Applicant's claims. Therefore, the rejections of claims 5, 7 and 8 as being unpatentable over Dennison in view of Avanzino are maintained.

Allowable Subject Matter

Claims 2 and 3 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christy L. Novacek whose telephone number is (571) 272-1839. The examiner can normally be reached on Monday-Thursday and alternate Fridays 7:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CLN
September 28, 2004



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